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THE PHENOTYPIC AND GENETIC ARCHITECTURE OF ADAPTATION: TAKING LENTILS OUT OF THEIR COMFORT ZONE

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Lentil (Lens culinaris Medik.) is grown in three major distinct agro-ecological zones: Mediterranean, sub-tropical savannah, and northern temperate. Genotypes from any one region fail to perform in the others due to problems related to phenology. Of key importance is the effect of local environment, such as daylength and temperature, on the plant's ability to flower and set seeds. Breeders are reluctant to use un-adapted material from other regions in their crosses, because this strategy requires additional time and resources to reduce the influence of the genes related to poor adaptation.

To better understand how lentil is adapted to different agro-ecological zones, and to identify markers for genes that control adaptation responses, we grew a diversity panel (Lentil AGILE) of 324 accessions, for two seasons in nine locations around the world: three each in South Asia (Bangladesh, India, Nepal), North America (Canada, USA), and around the Mediterranean (Italy, Morocco, Spain). Data were recorded for phenology and related traits, and environmental data were collected.

All accessions matured in the North America and Mediterranean environment, but only 1/3 reached maturity before the temperatures got too high in the South Asian locations. The South Asian lines typically flowered and matured very quickly in Mediterranean regions and North America, not leaving enough time to develop much seed. Across the accessions, however, there was a lot of variability in response across the different growing environments. All lines were also genotyped extensively to better understand the underlying genetic variability in these lines.

Here we present the results of phenotypic data and genomic information obtained from the AGILE consortium to shed light on the process of adaptation of lentil to different agro-ecological zones.